another: so also have the sectors." For the proof of these two propositions *only* is the fifth definition usually employed. All the remaining properties of proportion required for use in the sixth book are either assumed or proved (it would be more correct to say they are supposed to be proved) algebraically. Some teachers, probably a small minority, use the syllabus of the Association for the Improvement of Geometrical Teaching. This syllabus, following Euclid's line of argument, *uses the properties of unequal ratios to prove properties of equal ratios*, thus making the proofs unnecessarily artificial and therefore difficult; so that, though it is quite possible for a clever pupil to follow the reasoning in each separate proposition, it is very difficult for him to grasp the argument as a whole.

In the book under notice the fundamental definitions of the fifth book of Euclid, viz., the test for equal ratios, No. 5, the test for distinguishing between unequal ratios, No. 7, and the definition of the compounding of ratios, with which may be included the definition of duplicate ratio, find no place. And it may be conceded at once that, if these definitions are not properly explained, it is much better that they should not appear in an elementary text-book, because the beginner, to whom the simple ideas on which they rest are not carefully expounded, is far more likely to make progress in geometry with the aid of Prof. Holgate's book than with an ordinary Euclid.

The author, after defining the ratio of two incommensurable magnitudes as the limit of a rational fraction, obtained by a definite process (Art. 229), proves a general theorem on limits, viz., "that if there are two variable quantities dependent on the same quantity in such a way that they remain always equal while each approaches a limit, then their limits are equal" (Art. 230).

With the aid of this, the two propositions, Euc. VI., 1 and 33, already referred to, are proved, and also the proposition "that a straight line parallel to one side of a triangle divides the other two sides in the same ratio," Euc. VI., 2 (first part).

Taking the proof furnished of this last theorem as a type, and leaving out of it the use made of the general theorem on limits quoted above, it may be pointed out that the proof is in effect a demonstration (though some expansion would be necessary to make this clear) of the proposition that if a certain definite process be applied to the segments of each of the sides of the triangle the result will be to determine the same irrational number[1] in each case, so that this irrational number may be taken as the measure of the ratio of the two segments of each side, and that consequently these ratios are equal. With such a change the treatment would accord with modern ideas regarding irrational numbers as set forth by Dedekind in his tract on continuity and irrational numbers[2] and now generally accepted.

But when such propositions as "that if two ratios are equal, their reciprocal ratios are equal" are required (see Arts. 234, 237–240), then the proofs supplied are valid for commensurable ratios only. This change in the mode of treatment should have been clearly indicated in the text or preface. To have proved these propositions on the lines on which the treatment of the subject of ratio had been begun would soon have carried the author beyond the comprehension of those for whom his book was intended. To have proved them upon Euclid's lines would have made it necessary to add a large number of additional explanations. This, however, was the only practicable logical alternative.

The fourth chapter deals with the areas of plane polygons and with the measurement of the circle. Archimedes proved that π lies between $3\frac{1}{7}$ and $3\frac{10}{71}$ by a consideration of the regular inscribed and circumscribed polygons of ninety-six sides. The author obtains a much closer approximation, but finds only a series of values increasing up to π by using the inscribed regular polygons. The result would have been more impressive if a series of values decreasing down to π had been found as well.

The sixth chapter deals with lines and planes in space. It is a matter of opinion whether the modes of constructing the perpendicular to a plane in §§ 403 and 408 are or are not more difficult than Euclid's; but these last are so useful in Spherical Trigonometry that it seems a pity they have not had more prominence given to them than is furnished by § 406. For a similar purpose it would have been useful to give some further account of the angles between a line which meets a plane and the lines in the plane than Prop. xx. in § 449, viz., "The acute angle which a straight line makes with its own projection upon a plane is the least angle it makes with any line of that plane." It is advantageous to know, not only the least and the greatest angles between a fixed line meeting a plane and lines in the plane, but also the way in which the angle varies as the line in the plane revolves.

The statement of Prop. xxii., § 458, "that the sum of any two face angles of a trihedral angle is greater than the third angle," should be limited by inserting the word "convex" before the word "trihedral."

The seventh, eighth and ninth chapters deal with prisms, pyramids, cylinders, cones and spheres.

There are several features of interest in the book, such as the use of the principle of continuity in §§ 204, 264, 323, and the directions given in § 540 for constructing the regular polyhedra. The proofs of many of the propositions seem to be new. The work is evidently that of an experienced teacher, and is written on the lines of good class teaching, in which the teacher suggests steps in the argument to the pupil, and the demonstrations are worked out by both together. The book is calculated to arouse and stimulate those who have at heart the teaching of their subject.

[1] An irrational number is defined as one which separates all rational fractions into two classes, an upper and a lower, such that
(1) Every fraction in the lower class is less than every fraction in the upper class.
(2) The lower class contains no greatest fraction.
(3) The upper class contains no least fraction.

[2] Translated into English by Prof. Beman. (Chicago: The Open Court Publishing Co., 1901.)

MOSQUITOES AND MALARIA IN MAURITIUS.

Les Moustiques: Anatomie et Biologie. By A. Daruty de Grandpré and D. d'Emmerez de Charmoy. (Port Louis, Mauritius: *Planters' and Commercial Gazette*, 1900.)

THIS work is a contribution to the study of the Culicidæ, and principally of the genera Culex and Anopheles, of their *rôle* in the propagation of malaria

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and filariasis, and of the means of guarding against them. The authors recognise in Mauritius only the types of fever quartan, tertian and æstivo-autumnal, and have proved *Anopheles costalis* to be the definitive host of their parasites in that island. Three species of Culex —*C. anxifer*, *C. albopictus*, *C. taeniatus*—were shown to be incapable of infection by parasites of human malarial fever. *Anopheles mauritianas* also appears to have no relation to human malaria. The chapters on classification, morphology, anatomy and biology add but little to the literature of these subjects. In the present state of our knowledge of the ætiology of malaria and filariasis a more careful description of the minute anatomy of the organs of the adult insect would have been extremely useful; probably difficulties in the preparation of complete and perfect sections have prevented the authors giving minute histological details. Descriptions of such important structures as the membranous portion of the pharynx, of the salivary receptacle, and of the muscles attached to them, and, in view of the importance of the recent discoveries of the presence of filarial larvæ in the labium of the proboscis, the relations and histology of this organ especially, should have claimed the attention of these naturalists. The spermatheca of the female insect is not referred to.

The authors are evidently not acquainted with the structure of the parts of the proboscis. The salivary duct is described as uniting the pharynx to the œsophagus. Careful histological preparations show that this is far from correct; the salivary duct traverses the neck and head below the œsophagus and pharynx, and, in the region of the common origin of the mouth-parts from the head, the duct opens into the salivary receptacle—a chitinous trumpet-shaped organ with a wide membranous proximal end into the middle of which the salivary duct opens itself; while the narrow distal end is applied to the upper end of a groove—the salivary canal—which runs along the whole length of the hypopharynx.

The cells of the epithelium of the stomach are described as :—(1) Large spherical cells, with protoplasm not stained by carbol-thionin, while the nuclei stain pale rose-colour and the nucleoli violet. These are said to be of lymphocytic nature. (2) Small spherical cells, with a deep violet-staining nucleus, and protoplasm which centrally stains with difficulty while the periphery is deeply stained. These the authors consider to be digestive in their functions.

The epigastric glands of the larval stage, eight in number, surrounding the anterior part of the stomach, and the dialysing tube or membrane in the stomach wall, are considered as playing an important part in the digestive functions of the carnivorous larva.

With regard to filariasis, the authors apparently found only *F. nocturna* in the blood of the people of Mauritius where elephantiasis also occurs, and they have been able to trace the complete life-history of the larval stage of this nematode in the thoracic muscles of *Culex anxifer*.

The authors do not appear to have recognised the presence of malarial parasites in the blood of native children, and hence do not refer to segregation of Europeans as a preventive measure. "Eviter les Anopheles" is their advice, and they uphold the opinions of Ross and others that, although, perhaps, absolute extermination of the insects will prove impossible, even in small areas, yet their numbers may, by the application of inexpensive and practicable means, be easily reduced to an almost harmless minimum. They rely chiefly on the use of culicicides, particularly of petroleum, and of culicifuges, such as terebinthene and naphthalene.

H. E. A.

OUR BOOK SHELF.

Disease in Plants. By H. Marshall Ward, Sc.D., F.R.S., Professor of Botany in the University of Cambridge. Pp. xiv + 309. (London: Macmillan and Co., Ltd., 1901.) Price 7*s.* 6*d.*

THIS is a very suggestive work, and the clearness with which Prof. Ward has treated a difficult and complex subject will ensure for his book a welcome on the part of the specialist, not less than that of the wider public to whom the volume is more immediately addressed.

Most treatises on plant pathology deal with the more extrinsic aspects of the matter, such as the host and the parasite, and some of them give accounts of the evil results of an unfavourable environment. But in the book before us the questions raised are discussed from a more philosophical standpoint. The effort is made to discern wherein disease itself really consists, and to ascertain the actual relations and changes involved in the transition from the healthy or normal to the abnormal and pathological condition. "Disease (not diseases) in Plants" is the title of the book, and it fully indicates the general purport of the contents.

In order to place the reader in a position to appreciate the nature of the connection between a healthy and a diseased state, the opening chapters are devoted to a consideration of the normal physiology of the plant-organs and their relations with their surroundings. Then the various disturbing influences which make for, or actually induce, disease are passed under review, and their operations as far as possible explained. The imperceptible gradations by which an organism passes from the healthy to an unhealthy condition are pointed out, and the oftentimes indirect operation of an unfavourable influence is insisted on. One is brought into closer quarters with the heart of the matter on recognising that the most injurious factors are those which operate through the metabolic processes of the plant; just as, it may be remarked, is malnutrition in the widest sense at the bottom of so many of the ills which the animal flesh assumes itself to have inherited. The interference may come through unfavourable conditions of life, or it may be more immediately traced to influences exerted by other organisms such as parasites and the like. And these considerations open the way for discussing the question of "predisposition" and examining the various avenues in this direction leading to possible remedial measures.

Of course in a work of this kind there are some views put forward which may not command universal acceptance, but they are chiefly those concerned with side-issues, and can hardly be profitably discussed within the limits of a brief notice. Enough, it is hoped, has been said to emphasise the fact that the book forms a valuable contribution to a subject of vast importance. For on the right understanding of the nature and causes of disease in plants hang many great commercial and even national interests. The annual loss incurred through the agency of disease is enormous, but the results of current work clearly demonstrate that much of this loss can be curtailed or prevented when its causes are understood and empirical remedies have given place to intelligent counteraction.

J. B. F.

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